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EFFECT OF COIR PITH COMPOST, BONE MEAL POWDER AND PANCHAGAVYA ON GROWTH, CHLOROPHYLL CONTENT AND DMP OF BARNYARD MILLET

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ABSTRACT

To investigate the effect of different organic nutrient sources on growth, chlorophyll content and dry matter production of barnyard millet (*Echinochloa frumentacea* (Roxb.) Link) in sandy loam soil, a pot experiment was conducted at the Department of Soil Science and Agricultural Chemistry, Annamalai University during February-May, 2019. The weather at Annamalainagar was moderately warm with hot summer. The experiment was laid out in completely randomized block design (CRD) with nine treatments and three replications. The treatments of the study were T1– Control, T2 –100% RDF, T3 – Coir pith compost @ 10 t ha-1, T4 – Bone meal powder @ 1 t ha-1, T5 – Panchagavya @ 3 % (Foliar spray), T6 –T3 + T4, T7 – T4 + T5, T8 – T3 + T5 and T9 – T3 + T4 + T5. The results revealed that application of 100% RDF (N: P2O5: K2O @ 40:30:50 kg ha-1) (T2) recorded the highest plant height of 159.74 cm, number of leaves plant-1 (8.51), leaf area index (3.12), chlorophyll content (49.14) and dry matter production (472.30 g pot-1) at harvest stage. These were on par with T9 – CPC + BMP + PG.

Keywords: barnyard millet, *Echinochloa frumentacea* (Roxb.), coir pith compost, bone meal powder, panchagavya

INTRODUCTION

Millets are still the principal sources of energy, protein, vitamins and minerals for millions of poorest people. India is one of the major producers of millets in the world. The total production of minor millets in India is 6.83 lakh hectares with an average productivity of 630 kg ha^{-1}. (Agriculture statistics at a glance, 2015). The area under barnyard millet in India is about 1.95 lakh hectares and production of 1.67 million tonnes with a productivity of 857 kg ha^{-1} (Rashmi Yadev *et al.,* 2011). It is a rich source of protein (11.8%) and crude fibre (9.8%). Out of the total protein, it consists of 16.6% of amino acid (leucine), which is twice the quantity of rice, which is highly digestible and is an excellent source of dietary fiber. In recent years there is a huge awareness among people about healthy, nutritive millets and there is a demand for barnyard millet due to its nutritional quality and better adaptability. The spongy structure of coir pith facilitates retention of water in soil and slow release of nutrients. Bone meal is a mixture of finely and coarsely ground animal bones and slaughter-house waste products. It is a organic fertilizer rich in 12 to 16% of phosphorus. Panchagavya is an organic product has the potential to play a role of promoting growth and providing immunity in plant system thereby confers resistance against pest and disease. It contains several nutrients *i.e.,* macronutrients like N, P, K and micronutrients which are required for the growth and development of plant (Ragavendra *et al.,* 2014). This study aimed to assess the impact of integrated organic nutrient sources on growth parameters, chlorophyll content and dry matter production of barnyard millet.

MATERIALS AND METHODS

The present investigation was carried out to find out the effect of different organic nutrient sources on growth, chlorophyll content and dry matter production of barnyard millet (*Echinochloa frumentacea* (Roxb.) Link) in sandy loam soil through pot experiment was conducted at the Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalainagar during February-May, 2019. It is situated at $11^{0}24'$ North latitude and $79^{0}41'$ East longitude and at an altitude of +5.79 m above mean sea level. The weather at Annamalainagar is moderately warm with hot summer. The experiment was laid out in completely randomized block design (CRD) with nine treatments and three replications. The treatments are as follows: T_1– Control, T_2 –100% RDF, T_3 – Coir pith compost @ 10 t ha^{-1}, T_4 – Bone meal powder @ 1 t ha^{-1}, T_5 – Panchagavya @ 3 % (Foliar spray), T_6 –T_3 + T_4, T_7 – T_4 + T_5, T_8 – T_3 + T_5 and T_9 – T_3 + T_4 + T_5. Cement pots with the size of 45 x 30 x30 cm were used in the study and each pot was filled with 40 kg of processed soil. Recommended dose of N, P_2O_5 and K_2O for barnyard millet is 40:30:50 kg ha^{-1}. The calculated quantity of NPK fertilizers were applied for the particular treatment on dry weight basis. The organic nutrient sources *viz.,* coir pith compost and bone meal were applied @ 10 and 1.0 t ha^{-1}, respectively to the respective treatment. Panchagavya also applied as per

the treatment as seed treatment, seedling treatment and foliar spray @ 3%. The crop was grown up to maturity with proper care. Biometric observations *viz.,* plant height, number of leaves plant^{-1}, leaf area index recorded at 30, 60 DAS and at harvest stages. At harvest dry matter production also recorded with different treatments.

RESULTS AND DISCUSSION

Plant height (cm)

The data on plant height (cm) and number of leaves plant^{-1} of barnyard millet as influenced by different treatments at different growth stages are presented in table 1.

30 DAS

Plant height was significantly highest due to application of 100% RDF (T_2) (51.21 cm). It was on par with application of T_9 – CPC+BMP+PG registered the plant height of 50.76 cm. application of coir pith compost (T_3), bone meal powder (T_4) and panchagavya (T_5) recorded the plant height of 30.92, 26.96 and 32.01 cm, respectively. However, lowest plant height of 24.25 cm was observed under control (T_1).

60 DAS

Application of 100% RDF (N: P_2O_5:K_2O @ 40:30:50 kg ha^{-1} (T_2) registered the highest plant height of 117.31 cm was on par with T_9 – CPC+BMP+PG registered the plant height of 113.87 cm. Application of CPC+BMP(T_6), BMP+PG(T_7) and CPC+PG(T_8) recorded the plant height of 84.93, 80.74 and 101.62 cm, respectively. The treatment T_6 was on par with T_7.

At harvest

The plant height recorded by all treatments ranged from 93.61 cm to 159.74 cm. The lowest plant height 93.61 cm was recorded in control (T_1) which received no organic and inorganic fertilizers. Application of 100% RDF (T_2) registered the plant height of 159.74 cm was found to be on par with application of CPC+BMP+PG (T_9) (154.82 cm).

This shows the balanced application of nutrients through panchagavya and it contains growth promoting substances, enzymes, auxins, vitamins etc. These results are in conformity with the findings of Velmurugan (2005). Bone meal which is a rich source of phosphorus might have affected the protein synthesis positively leading to improved tree growth (Halvin *et al.,* 2012). Phosphorus through bone meal might be related to the cumulative effects of N, P and K as there play a pivotal role in the metabolic processes in plants. Similar findings have been reported by Mishra *et al*., (2011).

Number of leaves plant^{-1}

30 DAS

The number of leaves plant^{-1} was maximum (8.51) with 100% RDF (T_2) found to be on par with application of coir pith compost, bone mal powder and panchagavya (T_9) (8.48). However, the number of leaves plant^{-1} was minimum of 7.39 noticed in T_1- control.

60 DAS

Application of 100%RDF (N: P_2O_5: K_2O @ 40:30:50 kg ha^{-1}) (T_2) recorded the highest number of leaves plant^{-1} of 10.70 the treatment T_2 was on par with T_9 – CPC + BMP + PG (10.54). Application coir pith compost (T_3), bone meal powder (T_4) and panchagavya (T_5) registered the number of leaves plant^{-1} were 8.71, 8.38 and 8.75, respectively. Significantly lowest number of leaves plant^{-1} of 8.05 was observed with control treatment (T_1).

At harvest

The highest and lowest number of leaves plant^{-1} of 11.61 and 9.27 were found to be with application of 100% RDF (T_2) and control (T_1), respectively. Application of coir pith compost, bone meal powder and panchagavya (T_9) registered the number of leaves plant^{-1} of 11.55. The treatment T_2 was on par with T_9.

In pot experiment, the highest number of leaves plant $^{-1}$ on 30 DAS, 60 DAS and at harvest stage were 8.51, 10.70 and 11.61 recorded in T_2 (100% RDF). This was due to soil application of macro nutrients might have favoured better absorption of nutrients resulted in increased number of leaves plant^{-1}. A similar result was reported by Kumar *et al.,* (2015) in pear millet.

Leaf area index

The data on leaf area index significantly differed due to treatments at different growth stages are presented in table 2.

30 DAS

Significantly the highest leaf area index of 2.61 was noticed in T_2 - 100% RDF. It was on par with application of coirpith compost, bonemeal powder and panchagavya registered the leaf area index of 2.54. The treatment T_2 was on par with T_9. However, the lowest leaf area index (1.10) was observed under control (T_1).

60 DAS

The maximum and minimum leaf area index of 3.80 and 2.75 were noticed with 100%RDF (N: P_2O_5: K_2O @ 40:30:50 kg ha^{-1}) (T_2) and control (T_1), respectively. The combined application of coir pith compost, bone meal powder and panchagavya (T_9) registered the leaf area index of 3.68.

At harvest

Similar above trend was observed at harvest stage of barnyard millet. Significantly highest leaf area index (3.12) was obtained with T_2- 100% RDF. Application of coir pith compost (T_3), bone meal powder (T_4) and

Table 1: Effect of coir pith compost, bone meal powder and panchagavya on plant height (cm), number of leaves plant-1 at different stages of barnyard millet cv. CO 2.

Treatment details	Plant height (cm)			Number of leaves plant-1		
	30DAS	60 DAS	At harvest	30DAS	60 DAS	At harvest
T_1– Control	24.25	51.46	93.61	7.39	8.05	9.27
T_2 – 100% RDF	51.21	117.31	159.74	8.51	10.70	11.61
T_3 – Coir pith compost @ 10 t ha-1	30.92	69.20	109.83	7.86	8.71	10.10
T_4 – Bone meal powder @ 1 t ha-1	26.96	58.64	102.25	7.61	8.38	9.69
T_5 – Panchagavya@3% (Foliar Spray)	32.01	68.12	113.57	7.82	8.75	10.51
T_6 – T_3+T_4	36.67	84.93	126.40	8.07	9.08	11.38
T_7 – T_4 + T_5	36.12	80.74	123.07	8.02	9.04	10.48
T_8 – T_3 + T_5	42.75	101.62	137.62	8.28	9.82	10.92
T_9 – T_3+T_4+ T_5	50.76	113.87	154.82	8.48	10.54	11.55
S.Ed	0.91	2.08	3.01	0.08	0.17	0.18
CD (P = 0.05)	1.92	4.38	6.33	0.16	0.34	0.36

Table 2: Effect of coir pith compost, bone meal powder and panchagavya on LAI, Chlorophyll content and DMP of barnyard millet cv. CO 2.

Treatment details	Leaf area index			Chlorophyll content			Dry matter production (g pot -1)
	30DAS	60 DAS	At harvest	30DAS	60 DAS	At harvest	
T_1– Control	1.10	2.75	2.18	37.51	42.62	32.60	168.90
T_2 – 100% RDF	2.61	3.80	3.12	42.64	54.93	49.14	472.30
T_3 – Coir pith compost @ 10 t ha-1	1.57	3.11	2.50	39.31	46.23	38.17	261.25
T_4 – Bone meal powder @ 1 t ha-1	1.31	2.91	2.32	37.84	44.25	34.57	213.60
T_5 – Panchagavya@3% (Foliar Spray)	1.54	3.08	2.47	38.16	46.08	37.05	258.70
T_6 – T_3+T_4	1.89	3.30	2.66	40.29	49.17	41.44	348.95
T_7 – T_4 + T_5	1.87	3.19	2.64	40.05	47.18	40.84	326.40
T_8 – T_3 + T_5	2.26	3.49	2.81	40.92	51.16	44.67	414.90
T_9 – T_3+T_4+ T_5	2.54	3.68	3.08	41.95	53.75	47.88	464.79
S.Ed	0.08	0.07	0.06	0.29	0.90	0.97	18.72
CD (P = 0.05)	0.19	0.16	0.12	0.58	1.79	2.04	37.45

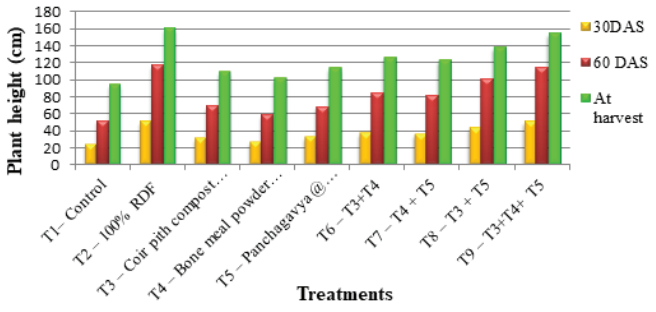

Fig.1. Plant height of barnyard millet cv. CO2 at different stages as influenced by in organic fertilizers, coir pith compost, bonemeal powder and panchagvaya in pot-culture experiment

panchagavya (T_5) recorded the leaf area index of 2.50, 2.32 and 2.47, respectively. However, the leaf area index was lowest (2.18) found to be with control (T_1). This might be due to fertilizer application in particular nitrogen helps maintenance of higher number of leaf, leaf area and leaf area index. The results are in conformity with the finding of Reddy (1999).

Chlorophyll content

30 DAS

Application of 100%RDF (N: P_2O_5: K_2O @ 40:30:50 kg ha^{-1}) (T_2) recorded the highest chlorophyll content of 42.64 was on par with 41.95 observed in T_9 which received the combined application of coir pith compost, bone meal powder and panchagavya. Application of coir pith compost (T_3), bone meal powder (T_4) and panchagavya (T_5) registered the chlorophyll content of 39.31, 37.84 and 38.16, respectively. However, the lowest chlorophyll content (37.51) was found to be with control (T_1).

60 DAS

The maximum chlorophyll content of 54.93 was significant due to application of 100%RDF (T_2). It was on par with T_9 – CPC + BMP + PG recorded the chlorophyll content of 53.75. The combined application of CPC+BMP (T_6), BMP+PG (T_7) and CPC+PG (T_8) recorded the chlorophyll content of 49.17, 47.18 and 51.16, respectively.

However, the chlorophyll content was minimum (42.62) noticed in T_1 – Control which received no organic nutrient sources and inorganic fertilizers.

At harvest

Similar above trend was also observed at harvest stage of barnyard millet. Significantly highest chlorophyll content (49.14) was noticed in T_2 which received 100% RDF (N:P_2O_5:K_2O @ 40:30:50 kg ha^{-1}). It was on par with T_9 (47.88) which received the combined application of coir pith compost, bone meal powder and panchagavya. However, the control registered the lowest chlorophyll content of 32.60.

This might be due to increase in chlorophyll content of plants by efficient utilization of resources such as solar energy, moisture and nutrients. The higher rate of nitrogen application also increased the chlorophyll content of the plant (Hokmalipour and Darbandi, 2011). This was also due to increased availability of nitrogen which is a main constituent of chlorophyll with increase in the dose of fertilizer.

Dry matter production

Significantly the highest dry matter production (472.30 g pot^{-1}) was obtained in T_2 – 100%RDF. It was followed by 464.79g pot^{-1} was found to be with combined application of coir pith compost, bone meal powder and panchagavya (T_9). The treatment T_2 was on par with T_9. Application of coir pith compost (T_3), bone meal powder (T_4) and panchagavya (T_5) recorded the dry matter production of 261.25, 213.60 and 258.70 g pot^{-1}, respectively. However, the lowest dry matter production (168.90 g pot^{-1}) was recorded with control (T_1).

The increase in dry matter production with higher dose of nitrogen, phosphorus and potassium brings luxuriant growth further increased NPK uptake resulted in higher number of leaves, leaf area index and greater accumulation of nutrients, which in turn contributed to higher plant dry weight (Singh *et al.,* 1979). This was closely followed by treatment T_9 (464.79 g pot^{-1}), which was received coir pith compost, bonemeal powder and panchagavya. This was due to the functions of organic nutrients brought about the increased plant height, number of tillers as well as leaves per plant up to the maximum extend and thereby increased dry matter accumulation per plant.

CONCLUSION

Based on the results of the pot-culture experiment, it can be concluded that application of 100%RDF (N: P_2O_5: K_2O @ 40:30:50 kg ha^{-1}) recorded the highest plant height, number of leaves $plant^{-1}$, LAI, chlorophyll content and dry matter production. This was on par with application of T_9 – CPC+BMP+PG to barn yard millet grown in sandy loam soil.

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